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(54) **RECHARGEABLE BATTERY PACK**

USPC 429/138, 151, 153, 163, 167, 176
See application file for complete search history.

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(57) **ABSTRACT**

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H01M 2/10 (2006.01)

H01M 2/02 (2006.01)

(52) **U.S. Cl.**

CPC **H01M 2/1016** (2013.01); **H01M 2/1061** (2013.01); **H01M 2/0245** (2013.01); **H01M 2200/00** (2013.01)

(58) **Field of Classification Search**

CPC H01M 2200/00; H01M 2/1016; H01M 2/1061; H01M 2/0245

A rechargeable battery pack includes a rechargeable battery, a mount frame wrapping at least part of the rechargeable battery, an outer case wrapped around the mount frame, the outer case including a first case including a first protrusion portion protruding therefrom, and a second case having a second protrusion portion protruding therefrom, the first protrusion portion being fixed to the second protrusion portion, and a protective circuit module electrically connected to the rechargeable battery.

8 Claims, 8 Drawing Sheets

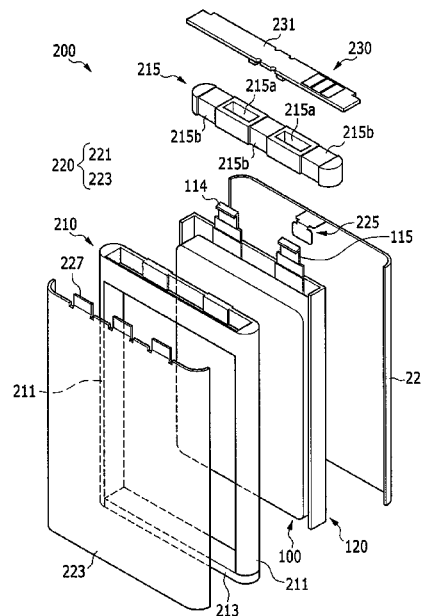


FIG. 1

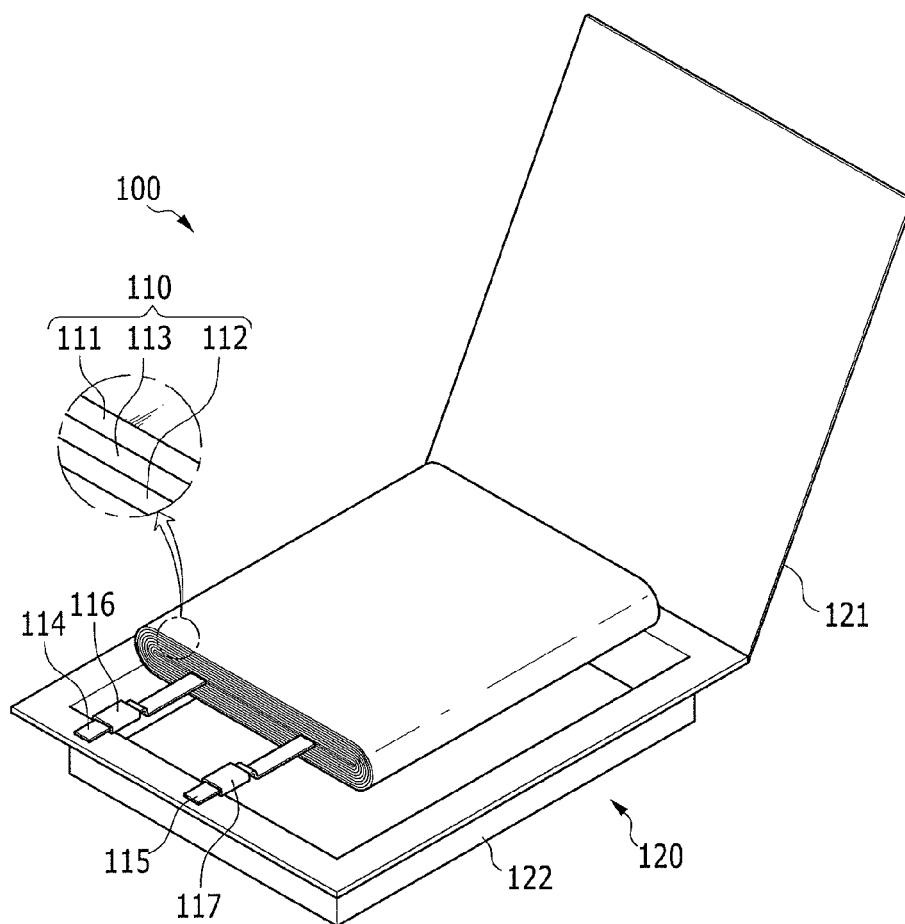


FIG. 2

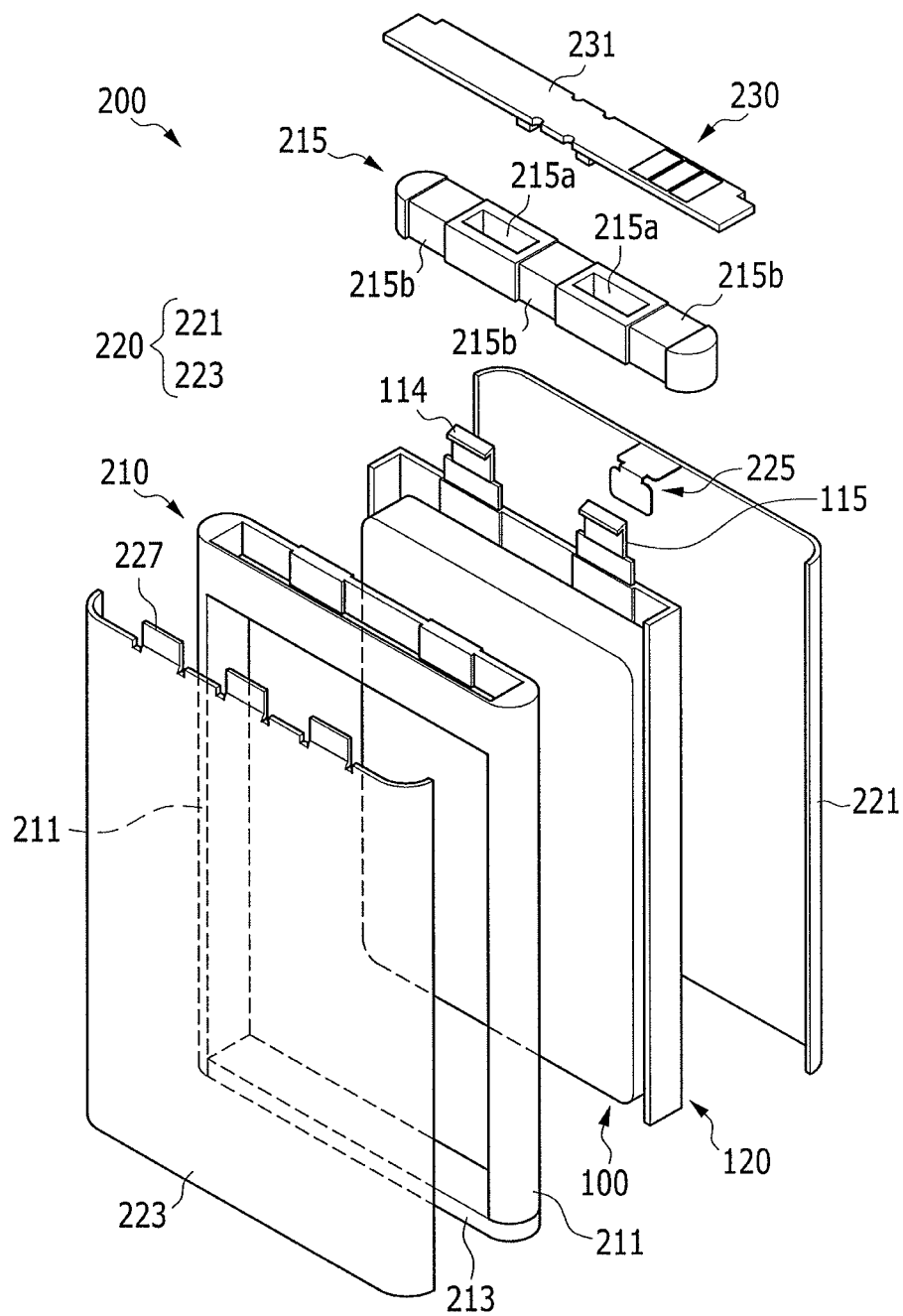


FIG. 3

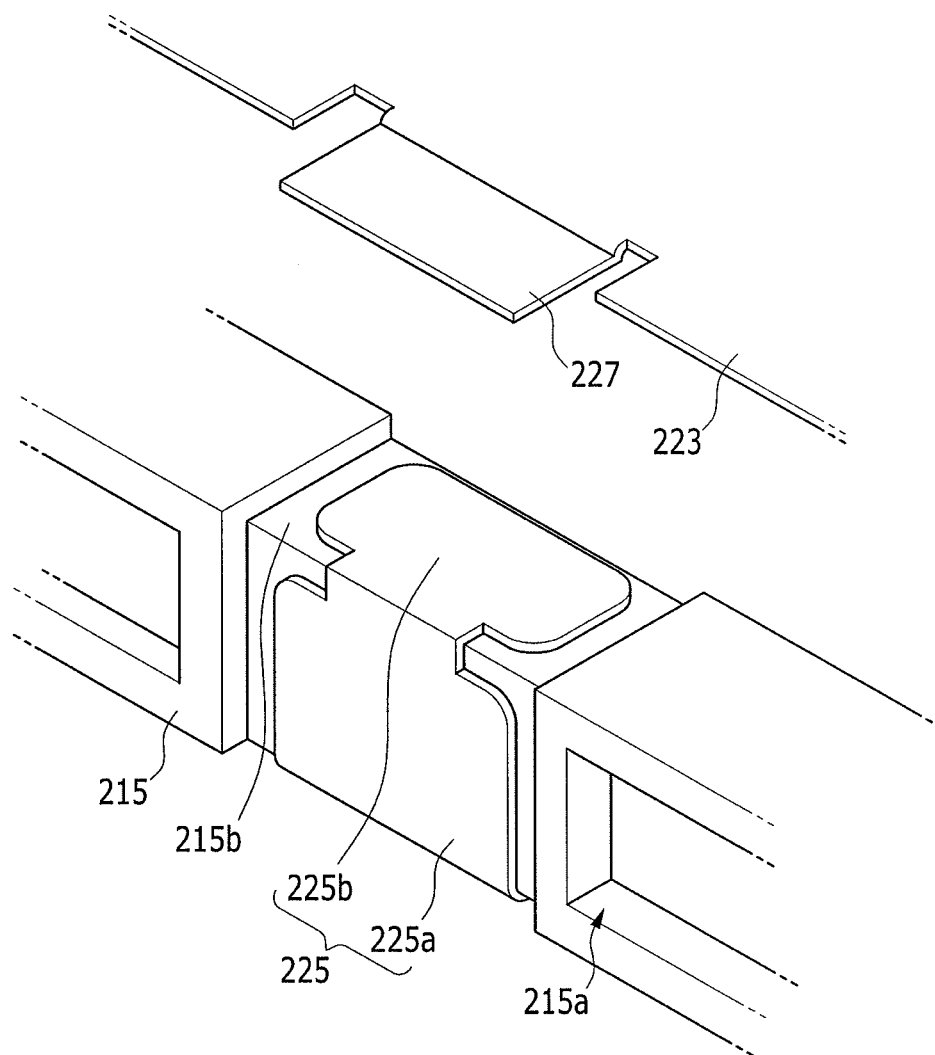


FIG. 4

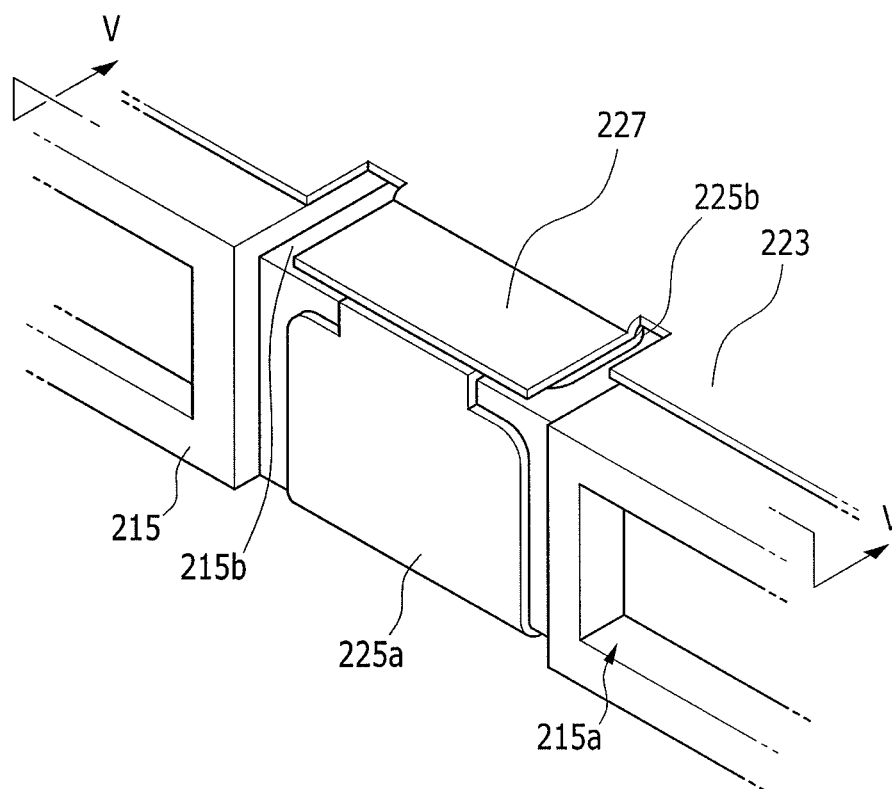


FIG. 5

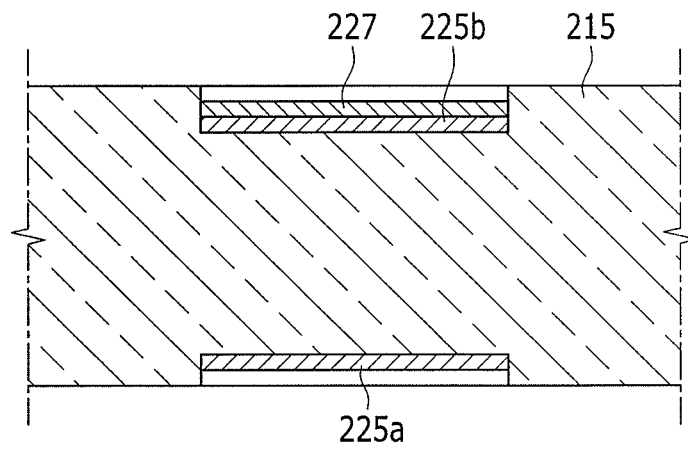


FIG. 6

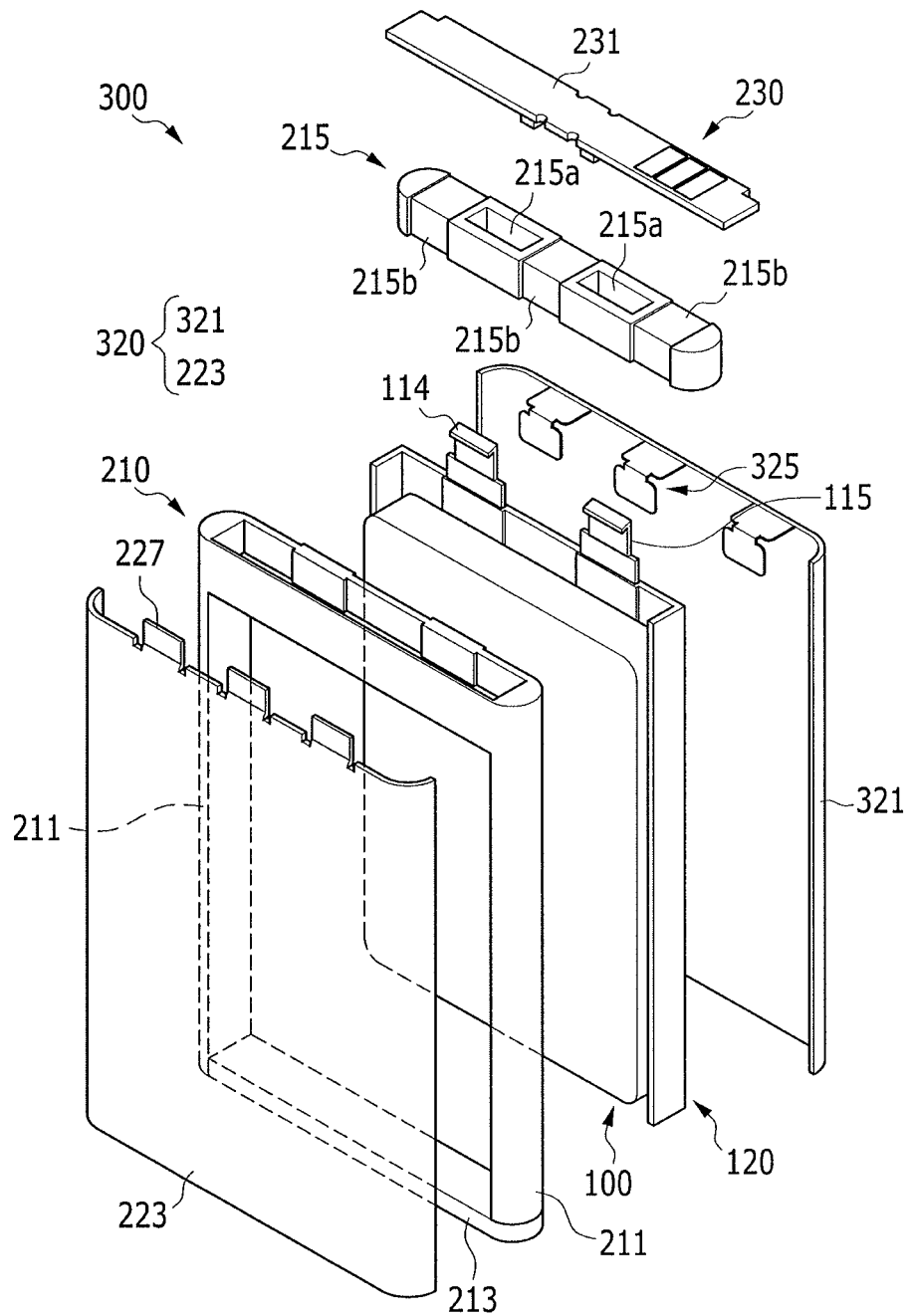


FIG. 7

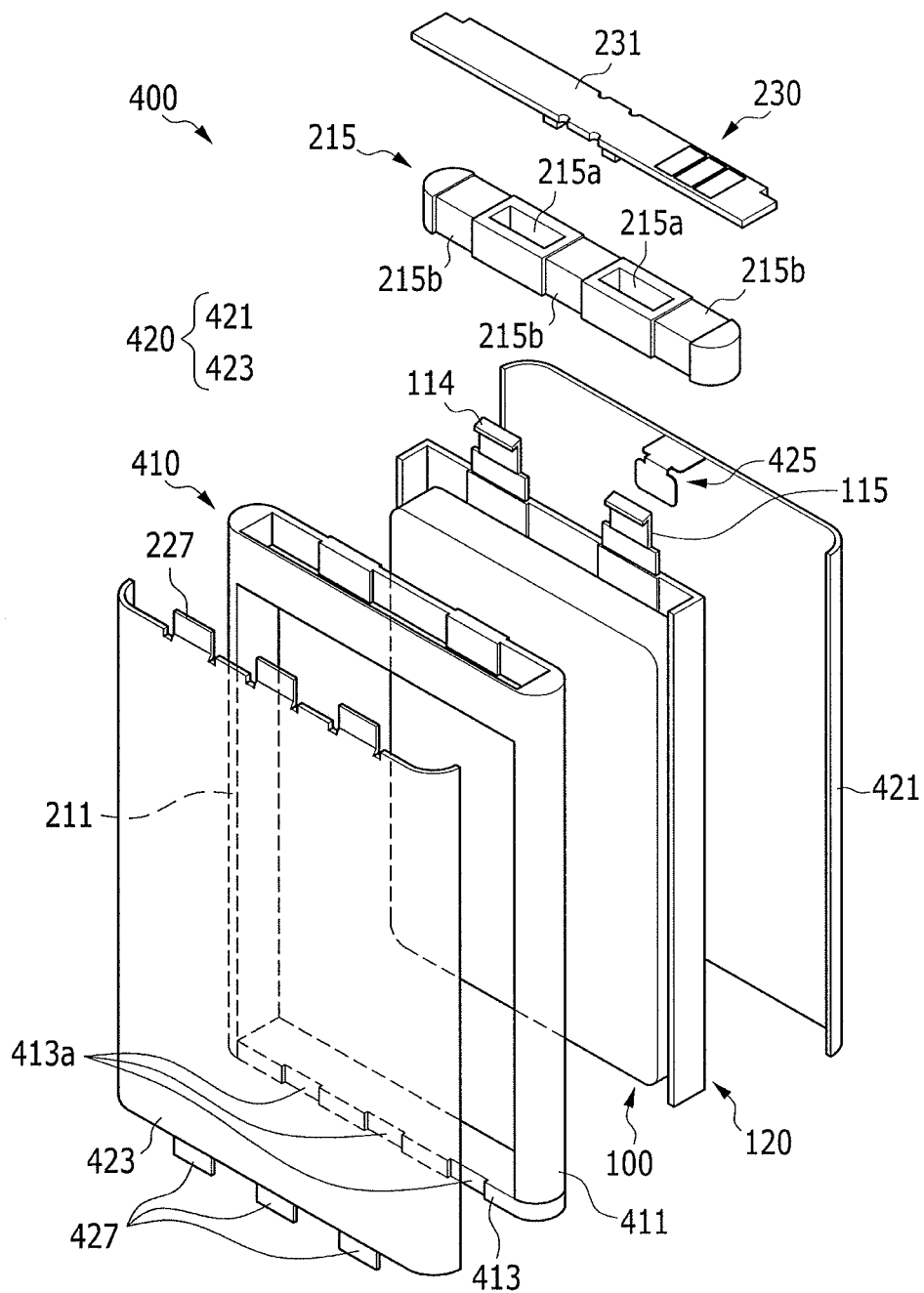
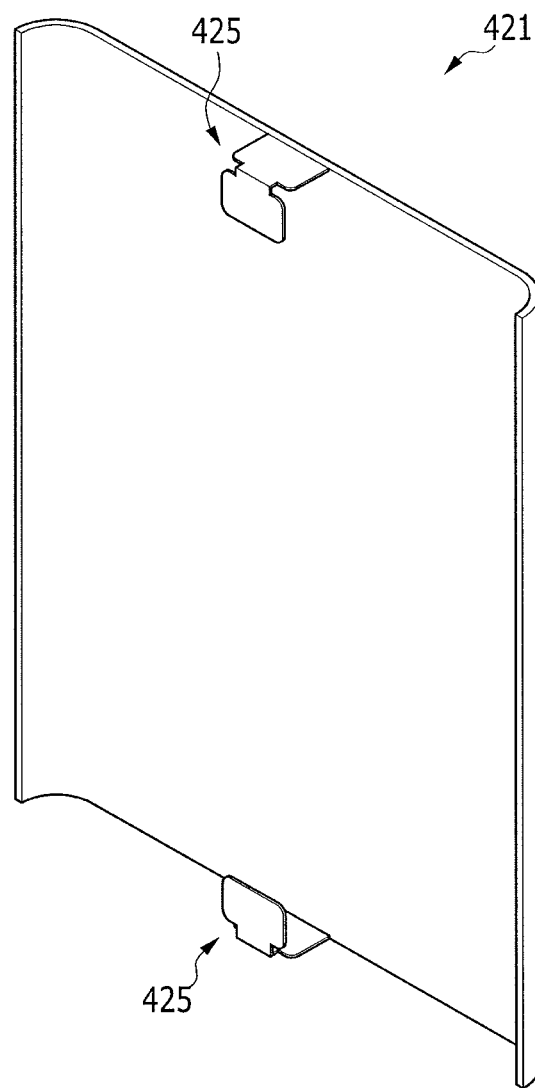


FIG. 8



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RECHARGEABLE BATTERY PACK**CROSS-REFERENCE TO RELATED APPLICATION**

Korean Patent Application No. 10-2013-0023992, filed on Mar. 6, 2013, in the Korean Intellectual Property Office, and entitled: "Rechargeable Battery Pack," is incorporated by reference herein in its entirety.

BACKGROUND

1. Field

Embodiments relate to a rechargeable battery pack.

2. Description of the Related Art

A rechargeable battery can be recharged and discharged repeatedly, unlike a primary battery. A small-capacity rechargeable battery is used for small portable electronic devices such as mobile phones, notebook computers, camcorders, and the like, while a large-capacity rechargeable battery is used as a motor-driving power source for a hybrid vehicle or the like.

Typical rechargeable batteries include a nickel-cadmium (Ni—Cd) battery, a nickel-hydrogen (Ni—NH) battery, a lithium (Li) battery, a lithium ion (Li-ion) rechargeable battery, and the like. An operating voltage of the lithium ion rechargeable battery is approximately three times higher than that of the nickel-cadmium battery or the nickel-hydrogen commonly used in portable electronic equipments. In addition, the lithium ion rechargeable battery is widely used due to advantages in terms of higher energy density per unit weight.

The rechargeable battery may use a lithium-based oxide as a positive active material, and a carbon material as a negative active material. In general, the lithium-based rechargeable batteries may be classified into a liquid electrolyte battery and a polymer electrolyte battery depending on the kinds of electrolyte. A battery using the liquid electrolyte is referred to as a lithium ion battery and a battery using the polymer electrolyte is referred to as a lithium polymer battery.

The above information disclosed in this Background section is only for enhancement of understanding of the background of the described technology and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

Embodiments are directed to including a rechargeable battery, a mount frame wrapping at least part of the rechargeable battery, an outer case wrapped around the mount frame, the outer case including a first case including a first protrusion portion protruding therefrom, and a second case having a second protrusion portion protruding therefrom, the first protrusion portion being fixed to the second protrusion portion, a protective circuit module electrically connected to the rechargeable battery.

The first protrusion portion may include an extension portion protruding from the first case in a first direction, and a fixing unit bent in a second direction crossing the first direction, the fixing unit being fixed to the second protrusion portion.

The mount frame may include a first frame covering opposing sidewall portions of the rechargeable battery, a second frame covering the bottom portion of the rechargeable battery, and a third frame coupled to the first frame and coupled to the protective circuit module.

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The third frame may include an inserting hole into which the first protrusion portion is inserted.

The first protrusion portion may include at least two first protrusion portions protruding to the outside of the first case.

The second protrusion portion may include a plurality of second protrusion portions protruding from one side of the second case in a direction of the third frame direction and a plurality of second protrusion portions protruding from another side of the second case in the second frame direction.

At least one first protrusion portion of the plurality of first protrusion portions and a respective second protrusion portion of the plurality of second protrusion portions may be coupled by resistance welding or laser welding in a state in which the first protrusion portion and the second protrusion portion are in contact with each other.

The outer case may be made of at least one of iron (Fe), aluminum (Al) or a stainless steel (SUS).

The first case and the second case may be coupled by resistance welding or laser welding.

BRIEF DESCRIPTION OF THE DRAWINGS

Features will become apparent to those of skill in the art by describing in detail exemplary embodiments with reference to the attached drawings in which:

FIG. 1 illustrates a drawing schematically depicting a rechargeable battery according to an exemplary embodiment.

FIG. 2 illustrates a partial exploded perspective view schematically depicting a rechargeable battery according to an exemplary embodiment.

FIG. 3 illustrates a drawing schematically depicting a state where a first protrusion portion protruding from a first case is mounted into an inserting hole of a third frame and a state where a second protrusion portion of the first case protrudes.

FIG. 4 illustrates a drawing schematically depicting a state where a first protrusion portion of a first case and a second protrusion portion of a second case are in contacted and fixed.

FIG. 5 illustrates a drawing taken along a line V-V of FIG. 4.

FIG. 6 illustrates a partial exploded perspective view schematically depicting a rechargeable battery according to another exemplary embodiment.

FIG. 7 illustrates a partial exploded perspective view schematically depicting a rechargeable battery according to another exemplary embodiment.

FIG. 8 illustrates a perspective view schematically depicting the first case of FIG. 7.

DETAILED DESCRIPTION

Example embodiments will now be described more fully hereinafter with reference to the accompanying drawings; however, they may be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey exemplary implementations to those skilled in the art.

In the drawing figures, the dimensions of layers and regions may be exaggerated for clarity of illustration. Like reference numerals refer to like elements throughout.

FIG. 1 illustrates a drawing schematically depicting a rechargeable battery according to an exemplary embodiment.

As shown in FIG. 1, the rechargeable battery 100 may include an electrode assembly 110 and a pouch 120 accommodating the electrode assembly 110. The electrode assembly 110 may be a structure in which a positive electrode 111,

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negative electrode **112**, and a separator **113** interposed between the positive electrode **111** and the negative electrode **112** are spirally wound.

The separator **113** is located between the positive electrode **111** and the negative electrode **112** to prevent a short and to enable the movement of the lithium ions. The separator **113** may be formed of a polyethylene (PE) or polypropylene membrane, or multi-layers thereof.

The positive electrode **111** may be electrically connected with a positive electrode tab **114**. In addition, the negative electrode **112** may be electrically connected with a negative electrode tab **115**. The positive electrode tab **114** may be bound with an insulation tape **116** for the positive electrode, and the negative electrode tab **115** may be bound with an insulation tape **117** for the negative electrode.

The pouch **120** may be a case that includes an upper case **121** and a lower case **122**. At least one side of the upper case **121** and lower case **122** may be integrally connected. The pouch **120** may have a three-layer structure including a metal foil and an insulating film laminated on both sides of the metal foil, as an example.

FIG. 2 illustrates a partial exploded perspective view schematically depicting a rechargeable battery according to an exemplary embodiment.

As shown in FIG. 2, the rechargeable battery pack **200** according to this exemplary embodiment may include a rechargeable battery **100**, a mount frame **210** wrapping at least part of the rechargeable battery **100**, an outer case **220** installed to be wrapped around the mount frame **210** and a protective circuit module **230** electrically connected to the rechargeable battery **100**.

The rechargeable battery **100** is provided with the pouch **120** accommodating the electrode assembly **110**. From one side of the pouch **120**, an end portion of the positive electrode tab **114** and an end portion of the negative electrode tab **115** are exposed to the outside. The pouch **120** may be a case with flexibility such that the pouch may be freely foldable in a state where the electrode assembly **110** is accommodated on the inside of the pouch **120**. At least part of the rechargeable battery **100** may be wrapped by the mount frame **210**.

The mount frame **210** may include a first frame **211** to cover two sidewall portions of the rechargeable battery **100**, a second frame **213** to cover the bottom portion of the rechargeable battery **100**, and a third frame **215** into which the protective circuit module **230** is installed. The first frame **211** and the second frame **213** of the mount frame **210** may be integrally formed. The mount frame **210** may be installed to be wrap around at least a portion of the outer surface of the rechargeable battery **100**. The mount frame **210** may be formed by injection molding using a polymer resin. In addition, the first frame **211** is installed with the third frame **215**.

The third frame **215** may be fixed to an opening of the first frame **211** by a fitting coupling. The third frame **215** may be formed with a through-hole **215a** through which a positive tab **114** and a negative electrode tab **115** may be exposed to the direction of the protective circuit module **230** direction. In addition, the third frame **215** may be formed with a plurality of inserting holes **215b**. The first protrusion portion **225** and the second protrusion portion **227** of the outer case **220** may be inserted into the inserting hole **215b**, as will be described in more detail below.

The protective circuit module **230** may be connected with the electrode assembly **110** to control the operation of the electrode assembly **110** including charging discharging. The protective circuit module may be made of a thin plate in the form of a rectangle elongated along one direction and may include a circuit substrate **231** printed as wiring pattern.

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The rechargeable battery **100** may be protected by the outer case **220** including the first case **221** and the second case **223**.

The first case **221** may be installed to cover a first side of the rechargeable battery **100** not protected by the mount frame **210**. The second case **223** may be installed to cover a second side of the rechargeable battery **100** not protected by the mount frame **210**. The first case **221** and the second case **223** may be installed on opposing sides of the rechargeable battery **100** to protect the rechargeable battery **100**.

The first case **221** and the second case **223** may be made of at least one of iron (Fe), aluminum (Al) or a stainless steel (SUS). Accordingly, the first case **221** and the second case **223** may be fixed by welding in a state where portions of the edges of the sides is overlap with each other. The first case **221** and the second case **223** may be fixed by resistance welding or laser welding in a state where a portion of an edge of the first case **221** is located to be overlapped with a portion of an edge of the second case **223**. In other implementations, the first case **221** and the second case may be coupled using a physical fitting. When the first case **221** and the second case **223** are coupled with the fitting, the sides of the first case **221** and the second case **223** may be formed with a protrusion and depression portion (not shown) to be fixed by the fitting using an elastic force. In addition, the first case **221** and the second case **223** may be coupled to the mount frame **210** using a fitting.

The first case **221** and the second case **223** may be fixed at a location of the third frame **215** by coupling the first protrusion portion **225** and the second protrusion portion **227**.

FIG. 3 illustrates a drawing schematically showing a state where a first protrusion portion **225** protruding from a first case **221** is mounted into an inserting hole of a third frame and a state where a second protrusion portion **227** of the second case **223** protrudes.

As shown in FIG. 3, the first protrusion portion **225** protrudes from the first case **221**. In this exemplary embodiment, even though it is illustrative that one of the first protrusion portions **225** protrudes to the outside of the first case **221**, in other implementations, at least two of the first protrusion portions **225** can protrude to the outside of the first case **221**.

The first protrusion portion **225** may include an extension portion **225a** integrally connected to the first case **221** and protruding in a first direction, and a fixing unit **225b** bent in a second direction crossing at the first direction and protruding. Here, the term "first direction" refers to a direction that is perpendicular to the plane of the first case **221**, and the term "second direction" refers to a direction that is horizontal to the plane of the first case **221**. In other implementations, the first direction and the second direction may be defined by other suitable predetermined angles.

One end of the extension portion **225a** may be integrally connected to an edge portion of the first case **221**. The extension portion **225a** may be made of the same metal material as the first case **221**, such as, for example, at least one of iron (Fe), aluminum (Al) or a stainless steel (SUS). The extension portion **225a** may extend to be bent in the direction of the second case **223** from the edge of the first case **221**.

The fixing unit **225b** may be bent in the second direction crossing the direction in which the extension portion **225a** protrudes. The fixing unit **225b** may be bent in the second direction at the end of the extension portion **225a** such that the fixing unit **225b** is located in the inserting hole **215b** of the third frame **215**. In the present exemplary embodiment, the first direction that protrudes from the extension portion **225a** and the second direction that protrudes from the fixing unit **225b** have the crossing angle of 90-degrees. In other implementations, the angles of the first direction and the second

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direction may be selected as a predetermined angle corresponding to a shape of the inserting hole **215b** of the third frame **215**. The second protrusion portion **227** of the second case **223** may be located on the upper side of the fixing unit **225b** in a state where one side of the fixing unit **225b** is mounted in the inserting hole **215b** of the mount frame **210**.

FIG. 4 illustrates a drawing schematically depicting a state in which a first protrusion portion of a first case and a second protrusion portion of a second case are in contact and are fixed, and FIG. 5 is a drawing taken along a line V-V of FIG. 4.

As shown in FIGS. 4 and 5, the first protrusion portion **225** of the first case **221** may be mounted in the inserting hole **215b** of the third frame **215**. In addition, the second protrusion portion **227** of the second case **223** may be located to be in contact with the upper side of the first protrusion portion **225**. The first protrusion portion **225** and the second protrusion portion **227** can be fixed by resistance welding or laser welding, or the like in a state where the first protrusion portion **225** of the first case **221** and the second protrusion portion **227** of the second case **223** are in contact. As a result, in a state where the first case **221** and the second case **223** are located on opposing sides of the rechargeable battery **100**, the first case **221** and the second case **223** may be coupled by welding such that the case **220** protects and improves the durability of the rechargeable battery **100**.

FIG. 6 illustrates a partial exploded perspective view schematically illustrating a rechargeable battery according to another exemplary embodiment. The same reference numbers of FIGS. 1 to 5 refer to the same members having the same functions. Hereinafter, detail description of the same reference numbers will not be repeated.

As shown in FIG. 6, the rechargeable battery pack **300** according to this exemplary embodiment includes the rechargeable battery **100**, the protective circuit module **230** electrically connected to the rechargeable battery **100**, and the outer case **320** located to be wrapped around the rechargeable battery **100** and including the first case **321** and the second case **223**. Here, at least two of the first protrusion portions **325** protrude from the first case **321**. The second protrusion portions **227** protrude from the second case **223** and are each fixed to corresponding ones of the first protrusion portions **325**.

This exemplary embodiment describes that three of the first protrusion portion **325** protrude from the edge of the first case **321**, as an example. Accordingly, three of the second protrusion portion **227** may protrude to the outside from the edge of the second case **223** to correspond to the number of the first protrusion portions **325**. The first protrusion portion **325** of the first case **321** and the second protrusion portion **227** of the second case **223** may be coupled by resistance welding or laser welding in a state of being in contact.

As described above, three of the first protrusion portions **325** of the first case **321** and three of the second protrusion portions **227** of second case **223** may be coupled by welding, respectively, and thus, durability of the case of the rechargeable battery pack may be improved.

FIG. 7 illustrates a partial exploded perspective view schematically depicting a rechargeable battery **400** according to another exemplary embodiment and FIG. 8 illustrates a perspective view schematically depicting the first case **421** illustrated in FIG. 7. The same reference numbers of FIGS. 7 to 8 refer to the same members having the same functions. Hereinafter, detail description of the same reference numbers will not be repeated.

As shown in FIGS. 7 and 8, the rechargeable battery pack **400** according to this exemplary embodiment includes the

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rechargeable battery **100**, the mount frame **210** wrapping at least one portion of the rechargeable battery **100**, the protective circuit module **230** electrically connected to the rechargeable battery **100**, and the outer case **420** wrapped around the rechargeable battery **100**. The outer case **420** includes the first case **421** and the second case **423**.

The one of the first protrusions **425** may protrude from the top of the first case and another of the first protrusions may protrude from the bottom of the first case **421**. One first protrusion **425** may protrude from the top side of the first case **421** in a direction of the third frame **413** direction and another first protrusion **425** may protrude from the bottom side of the first case **421** in a direction of the second frame **413**.

The first protrusion **425** may be formed to be the same shape and size at the top and bottom of the first case **421**. Since the first protrusion **425** of this exemplary embodiment is the same as that of the first embodiment, the detail description will not be repeated.

The mount frame **410** includes the first frame **411** to cover two sidewall portions of the rechargeable battery **100**, the second frame **413** to cover the bottom portion of the rechargeable battery **100**, and the third frame **215** on which the protective circuit module **215** is installed.

The second frame **413** may be formed with a coupling hole **413a** for fixing in a state where the first protrusion portion **425** of the first case **421** and the second protrusion portion **427** of the second case **423** are inserted. Thus, the first case **421** and the second case **423** can install more stable while improving durability by fixing The first protrusion portion **425** and the second protrusion portion **427** at the locations of the third frame **415** and the second frame **413** may be fixed by welding. Accordingly, stability and durability of the first case **421** and the second case **423** may be improved.

By way of summation and review, a rechargeable battery may be provided with a protective circuit module to control charging and discharging. The protective circuit module may prevent over-charge and/or over-discharge of the rechargeable battery and may serve to improve the safety and cycle-life of the rechargeable battery.

In such a rechargeable battery, the electrode assembly and the protective circuit module may include a case to wrap the outside of the electrode assembly, as a way to protect the rechargeable battery from external impact or the like. In this case, if the case is physically coupled into the outside of the electrode assembly only by a fitting, there is risk that the durability may be deteriorated due to deformation of the fixed part in the event of external impact to the case.

Embodiments provide a rechargeable battery pack having a case that may provide improved durability. A case to protect the rechargeable battery may include a first case and a second case that are welding-coupled to each other in a state where the first case and the second case are wrapped around the rechargeable battery. Thereby the durability of the rechargeable battery pack may be improved.

Example embodiments have been disclosed herein, and although specific terms are employed, they are used and are to be interpreted in a generic and descriptive sense only and not for purpose of limitation. In some instances, as would be apparent to one of ordinary skill in the art as of the filing of the present application, features, characteristics, and/or elements described in connection with a particular embodiment may be used singly or in combination with features, characteristics, and/or elements described in connection with other embodiments unless otherwise specifically indicated. Accordingly, it will be understood by those of skill in the art that various changes in form and details may be made without departing from the spirit and scope as set forth in the following claims.

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What is claimed is:

1. A rechargeable battery pack, comprising:
 - a rechargeable battery;
 - a mount frame wrapping at least part of the rechargeable battery;
 - an outer case wrapped around the mount frame, the outer case including a first case including a first protrusion portion protruding therefrom, and a second case having a second protrusion portion protruding therefrom, the first protrusion portion being fixed to the second protrusion portion; and
 - a protective circuit module electrically connected to the rechargeable battery,
 wherein the first protrusion portion includes:
 - an extension portion protruding from the first case in a first direction, and
 - a fixing unit bent in a second direction crossing the first direction, the fixing unit being fixed to the second protrusion portion.
2. The rechargeable battery pack as claimed in claim 1, wherein the mount frame includes:
 - a first frame covering opposing sidewall portions of the rechargeable battery;
 - a second frame covering a bottom portion of the rechargeable battery; and
 - a third frame coupled to the first frame and coupled to the protective circuit module.

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3. The rechargeable battery pack as claimed in claim 2, wherein the third frame includes an inserting hole into which the first protrusion portion is inserted.

4. The rechargeable battery pack as claimed in claim 3, wherein the first protrusion portion includes at least two first protrusion portions protruding to the outside of the first case.

5. The rechargeable battery pack as claimed in claim 4, wherein the second protrusion portion includes a plurality of second protrusion portions protruding from one side of the second case in a direction of the third frame direction and a plurality of second protrusion portions protruding from another side of the second case in the second frame direction.

6. The rechargeable battery pack as claimed in claim 5, wherein at least one first protrusion portion of the plurality of first protrusion portions and a respective second protrusion portion of the plurality of second protrusion portions are coupled by resistance welding or laser welding in a state in which the first protrusion portion and the second protrusion portion are in contact with each other.

7. The rechargeable battery pack as claimed in claim 1, wherein the outer case is made of at least one of iron (Fe), aluminum (Al) or a stainless steel (SUS).

8. The rechargeable battery pack as claimed in claim 1, wherein the first case and the second case are coupled by resistance welding or laser welding.

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